Aesthetic and Cosmetic Dentistry Made Easy®

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Aesthetic and Cosmetic Dentistry Made Easy®

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Aesthetic and Cosmetic Dentistry Made Easy®

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Dedicated to

My "Naniji" Smt. Phool from whom I learnt devotion and parity (non-partiality).

My "Mother" Smt. Gur Peari (Kailash) from whom I learnt discipline and punctuality.

My "Father" Dr. Brij Bansi Lal from whom I learnt lesson of contentment and simplicity.

My "Mausi" Smt. Kiran (Kinno) and Dr. PC Tawakli from whom I learnt the lesson of "laugh" and "gratification".

My "Brother" Ashok Kumar from whom I learnt the lesson of hard working and how to win friends.

My "Teachers" from whom I learnt the perfect art and science of dentistry.

My "Idol" A. Prasad from whom I learnt elegance and grace.

My "Chum" S.K. Bisaria from whom I learnt consistency and dignity of labour.

My "Mother-in-law" Smt. Rukmani from whom I learnt meaning of affection and blessings.

My "Wife" Dr. Smt. Nirmala Mathur who filled my life with care and comfort.

My "Patients" from whom I learnt the lesson of faith and trust.

(All these lessons made me, what I am today).

–PB Mathur

PREFACE

Aesthetic and Cosmetic Dentistry Made Easy is written for practising dental surgeons and students.

The authors are very experienced clinicians having a vast experience of dental practice and have highlighted in this book, the common procedural mistakes, which ultimately result in failures leading to frustrations both for the patients and the dentists.

First chapter is about the origin and scope of "Aesthetic and Cosmetic Dentistry". Next four ones give briefings about the "Materials" used in aesthetic and cosmetic dentistry (along with their commercial/brand names and names of the companies that manufacture them). Bonding generation chart is a special feature explaining names/brands/flaws/benefits/date of invention and relative information about the "Bonding materials" (generally we say 1st, 3rd and 4th generations, etc. You will know the exact meaning of these "terms" from this chart).

Remaining chapters explain what you ought to know about a successful practice of aesthetic and cosmetic dentistry. In accompanying audio-visual DVD, we have given actual working movie films of different procedures of "Aesthetic Dentistry" on patients, models, etc.

Hope and wish this book would help you in your day-to-day successful practice of aesthetic and cosmetic dentistry.

Pramod Bansi Mathur
Sanjay Bansi Mathur

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Chapter 1

Introduction

SCOPE

In recent years the maximum, ever possible progress was made in the field of "Aesthetic/adhesive dentistry" because this branch of dentistry has made it possible to retain natural teeth, which were aesthetically ugly looking. For example, broken/chipped corner teeth, teeth with spacing (diastema) stains, dark-shaded teeth (deep coloured) and specially in older persons where spacing, sensitive teeth due to attrition, abrasion and abfraction lesions, dark-shaded teeth which were unacceptable, aesthetic and cosmetic dentistry proved a boom in retaining these defective unacceptable teeth into acceptable and aesthetically beautiful looking natural teeth. In all discoloured, broken, chipped, abraded, abfraction lesioned and periodontally involved loose teeth, light-cure bonding, capping, crown and bridge techniques have proved very helpful.

HISTORY OF BONDING MATERIALS

In 1954 Buonocore demonstrated that after "etching" the tooth with phosphoric acid, which made microspores in enamel, it was possible to "bond" self-cure acrylic resin on this etched surface of enamel.

But, however, this bond was too weak to stand the loading material's heavy shrinkage forces during polymerization and the material used to detach, hence his concept did not get momentum.

But "experimenting" on these lines in 1960 "Bowen" introduced Bis-GMA resin with fillers. With the introduction of his invention "Aesthetic and cosmetic" dentistry came to real existence and success.

Due to the merits of the result of these experiments both the dentists and the manufacturers of adhesive

dentistry materials, became interested in this branch and the adhesive dentistry marched ahead in leaps and bounds.

It was soon realized that inspite of good retention properties, "Bis GMA" caused postoperative sensitivity and pulpal damage which leads to pulpal death. It was soon found that the defect was in the adhesion to dentine by hydrophobic resins of that time.

SMEAR

The "smear layer" that formed over the cut dentinal surface consists of hydroxylapatite crystals and denatured collagen fibres of dentine. This "smear layer" tends to seal the open dentinal tubules and act like a "lid" preventing the penetration of bonding fluids into the cut dentinal tubules. The earlier adhesives materials used to bond to this dry smear layer and this smear layer itself was loosely attached to the underlying dentine, hence the material bonding to this smear layer was not very strong (2-6 MPa) and used to detach under stresses of polymerization shrinkages of the loading composite materials.

CONDITIONING

This defect, however, was overcome by either removal (total etch conditioning) or by penetration of the smear layer. The bonding strength of 22 MPa (megapascals) or above could be achieved and is satisfactory. However, in abfraction lesions at cervical position of the teeth of older patients, where due to less periodontal support of the tooth and comparatively thinner (without prisms) layer of enamel and peritubular dentine structure and shallow saucer-shaped lesions, all these factors make important contribution in debonding of the material in the cervical restorations. Because any bonding agent will be influenced

by the properties of the composite to which it is attached, polymerization shrinkage, moisture absorption and coefficient of thermal expansion and contraction of the loading composite shall influence the load stress on the "bonding" agent through which it is attached to enamel and dentine of the tooth.

Recent generation's "dentine bonding materials" either remove, penetrate or solubilise the smear layer and wet the underlying dentine with its hydrophilic monomers (liquid). The smear layer can be removed by "total etch" with 34 to 37 per cent ortho-phosphoric acid for not more than 15 to 20 seconds (otherwise it will denature the collagen network of dentine and dentine will collapse).

This process will condition the enamel and dentine which can then be washed with air-water spray for 5 to 10 sec. After this conditioning, hydrophilic monomer in alcohol/acetone base can penetrate the decalcified intertublar dentine upto 1-5 microns. This zone of penetration of monomer is called the "hybrid zone" interpenetration or interdiffusion zone. This is the main site for enamel and dentine adhesion. After light-cure for 10 seconds these millions of threads/tentacles have physical catchment with resultant bonding strength of more than 22 megapascals (MPa). However, penetration of these bonding materials into the dentinal tubules does not seems to increase its bonding strength. It is the collagen fibres of the dentine which gives strength to the attached tentacles.

WHAT IS "BONDING"

Thirty-seven per cent phosphoric acid after application for 15 seconds on enamel and dentine will dissolve the inorganic "rods of enamel" and "tubules of dentine" sparing the "organic matrix" intact.

The pressure spray of water and air will remove the etchant gel along with residue of dissolved "enamel rods" and "dentinal tubules" leaving behind millions of spores (1-5 microns deep) which were previously occupied by inorganic enamel rods and dentinal tubules when the area is blot dried and water is withdrawn from them they become hollow tubes. Now when the "Primer" is applied for 20 seconds over them the liquid infiltrates into these hollow tubes by osmosis and fill them. After 20 seconds the excess "Primer" (solvent base Alcohol/Acetone) is blown (Air thinned) by air blasts for 1 to 2 seconds leaving behind thin surface of "Primer". Then it is light-cured for 10 seconds. The liquid which had infiltrated inside the hollowed tubes along with the surface layer will get cured and shall get physically "attached" (Bonded) to enamel and dentine of the tooth. The surface layer of primer is now loaded with flowable/regular filled composite and light-cured, so this layer shall get "Bonded" to surface layer of "Primer".

Hence the regular composite material will get attached (bonded) to surface layer of "Primer" which in turn is attached to tooth (enamel and dentine) by millions of tentacles. This is the integral part of the so-called term "Bonding." This mechanism should be crystal clear in the mind of operator (See Figs 1.1 to 1.8). Worth mentioning here is that if phosphoric acid concentration is high or if it is applied for a longer duration than 15 seconds or if more penetrating (corrosive) acids like hydrochloric acid/ sulphuric acid, etc. are used, they will attack the "organic matrix" of dentine denaturing the collagen fibres after which the dentine shall collapse and shall not be left suitable for bonding. Enamel, however, can tolerate acid better than dentine because of its compact and hard matrix, hence can be etched a little longer than dentine (see Fig. 7.7).

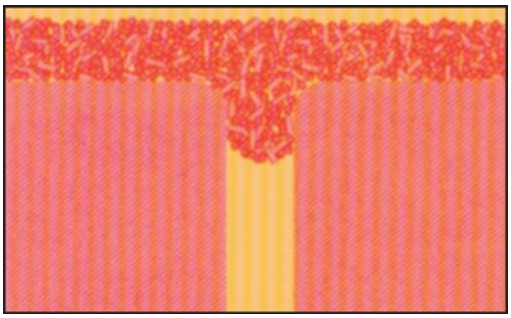

Fig. 1.1: A smear layer forms on the dentine during tooth preparation, the smear layer which covers the surface of the dentine and plugs the tubules, requires conditioning to prepare the tooth for bonding

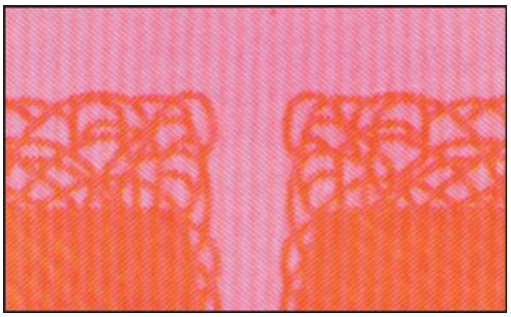

Fig. 1.2: The total-etch technique uses phosphoric acid to condition the dentine, subjecting both the enamel and the dentine to acid, which must then be properly rinsed and dried. Doing so removes the smear layer and the dentine plugs entirely and prepares a hybrid zone for resin infiltration to support bonding. It also exposes the dentine and dentine tubules to air, oral fluids and bacteria. That coupled with the chance of over drying increases the possibility of postoperative sensitivity and poor bond strength

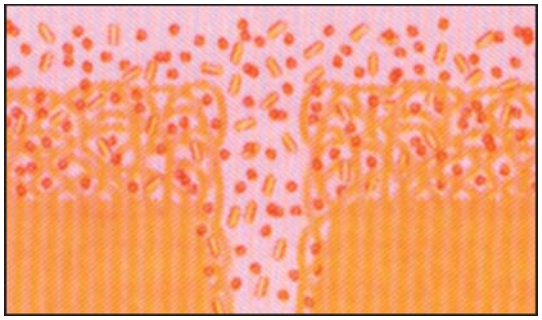

Fig. 1.3: Rather than removing the smear layer and exposing the dentine and dentine tubules, self-etch materials incorporate into the hybrid zone. Adhesive resin can then infiltrate the hybrid zone and penetrate the tubules, preparing the dentine for bonding. In this way, self-etch materials help control sensitivity as well as eliminate technique-sensitive steps associated with total etch, which makes bonding more efficient

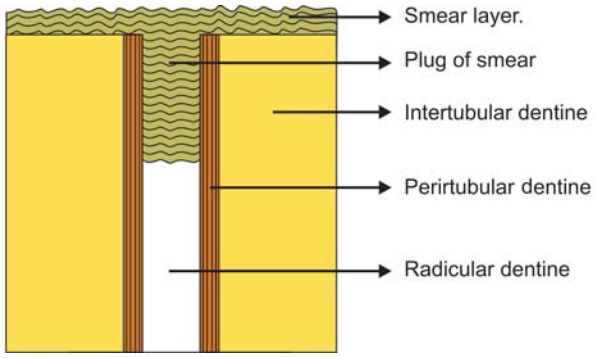

Fig. 1.4: Ground dentine

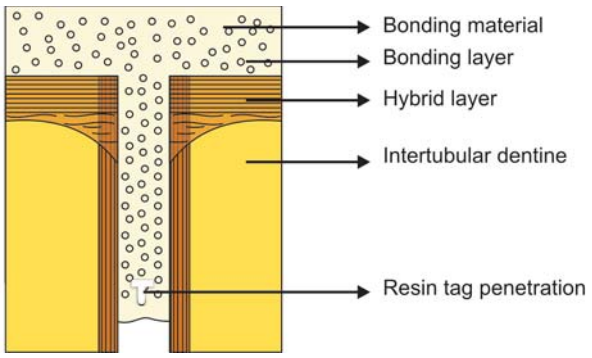

Fig. 1.5: Dentine with FL-bond/Primer

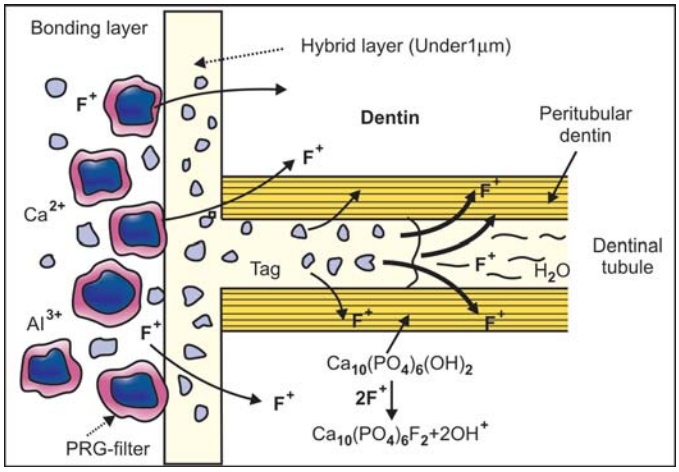

Fig. 1.6: Fluoride release into dentine

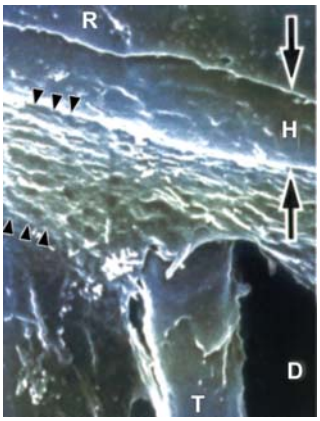

Fig. 1.7: The above scanning electron microscope image shows an intimate bonding interface (H and R) between nano bonding material and dentine

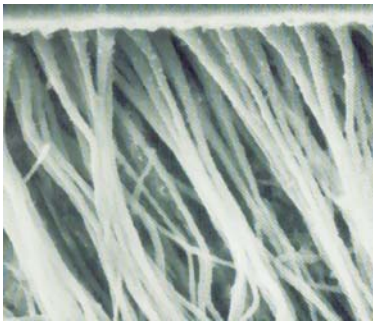

Fig. 1.8: This SEM shows the effective penetration of OptiBond Solo Plus when used with its Self-Etch Primer. The result is excellent infiltration into the hybrid zone and the dentinal tubules, forming deep resin tags

We are now entering the post-amalgam age of operative dentistry with an increasing trend toward the use of tooth coloured amalgam substitutes and alternatives.

CHAPTER 2

Recent Advances in the Improvement of Materials Used in "Aesthetic Dentistry"

BONDING MATERIALS "FILLED DENTAL PRIMERS"

Recently addition of fillers in the dentine bonding materials have immensely increased the bonding strength and marginal integrity. But unfortunately addition of fillers makes the bonding material more viscous and the resultant film thickness exceeding 15 microns shall make them unsuitable for bonding indirect restorations.

The latest introduction is Nano-scale size fillers which are almost 100 times smaller than regular micron fillers. The nano fillers have revolutionized adhesive bonding with deeper penetration of resin liquid into hybrid area along with fillers which result into increased strength and better seal of the cavo surface margins and less setting shrinkage due to presence of more particles/fillers.

The following nano filled dentine adhesives are available commercially.

i. Prime and bond NT™ (Dentsply)
ii. Opti-bond solo plus™ (Kerr)
iii. Excite (Ivoclar)

Table 2.1: Bonding generation chart

Bonding generation	*When Invented*	*Characteristics*	*Bonding strength to dentine*	*Examples*	*Components*
7th	Recent	Single component Desensitizing Self-etching Self-priming No mixing Moisture independent Bonds to metal Very little-no sensitivity	18-25 MPa	iBOND	1

Contd....

Contd....

Bonding generation	*When Invented*	*Characteristics*	*Bonding strength to dentine*	*Examples*	*Components*
6th	Recent	Multi-component Multi-step Self-etching (enamel?) Self-priming Hybridization Very little sensitivity	18-23 MPa	Prompt-L-Pop SE Bond Liner Bond ll	2-3
5th	2000's	Single component Moist bonding Hybridization No mixing Little sensitivity	20-24 MPa	Gluma Comfort Bond Prime & Bond NT Single Bond Excite One Step Bond 1	1
4th	Early 90's	Hybridization Total etch Little sensitivity	17-25 MPa	All Bond ll Pro Bond Scotchbond MP Tenure Bond it Syntac	2-5
3th	Late 80's	2 component primer and adhesive system Bonding to metals Reduced sensitivity	8-15 MPa	Prisma Universal Bond Scotchbond ll Tenure Gluma X-R Bond	2-3
2nd	Early 80's	Weak adhesives requiring retentive preps Prone to water degradation/	2-8 MPa	Bond lite Scotchbond Dentine Adhesit	2
1st	Late 70's	Very weak bond to dentine	2 MPa	Cervident Cosmic Bond	1

MICROFILL LIKE HYBRID COMPOSITE

Hybrid composites have proved their worth in even stress bearing areas of class II and class IV cavities, but the major disadvantage is that they are difficult to polish because of the size of the fillers which leaves ditches when these fillers get dislodged. This defect of the material can be overcome to some extent by better polishing technique available (Enhance™, Dentsply) but this polish also gives way against abrasion and the restoration looks rough and stained. Hence periodic maintenance becomes mandatory. *The best example for "composite" that can be given is by comparing it with "mosaic" floor in buildings and houses, "Bis-GMA" is like cement base and "fillers" are like stone pieces incorporated into the cement. More the stone pieces more the hardness, when the cement along with incorporated stone pieces in the floor sets, it is polished by surface grinding to result into a smooth, hard and shiny floor, exactly like this "Bis-GMA" base with fillers after light-curing become hard and its polishing results into shiny and hard surface of the fillings, much harder than "Bis-GMA" alone.*

The recent introduction of improved hybrids have fluoride glass fillers (0.6 µm to 0.8 µm) and a narrow particle size distribution. This results in less viscous, sculptable, non-sticky, superior polish attaining, long lasting and better polishable material with of course very low polymerization shrinkage (Because of reduced quantity amount of base material (Bis-GMA) which can shrink, but the fillers cannot shrink by polymerization process).

The examples are :

i. Esthet-X™ (Dentsply) with 31 body shades, 3 opacities and 5 translucent enamels to replicate any tooth colour.
ii. Point-4™ (Kerr)

iii. Renew™ (Bisco)
iv. Vitalescence™ (Ultradent).

PREREACTED GLASS (PRG) IONOMER TECHNIQUE

The PRG is a new technology from "Shofu Inc" to form a stable phase of glass ionomer through advance reaction of acid active fluoride containing glass and polyacid under the presence of water. This technology can be further classified into two categories F-PRG (Reaction of entire glass) and S-PRG (Reaction of only the glass surface). These SPRG fillers plus resin forms "Gio-mer" is commercially called Beautifil™ (Shofu Inc) (See fillings with Beautifil™ in Figs 7.26 to 7.31).

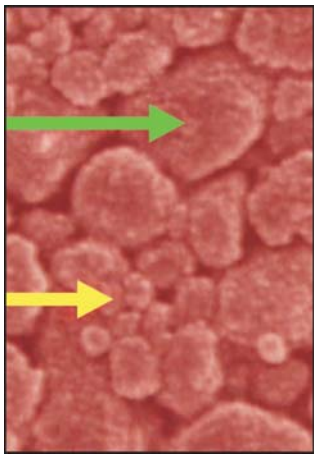

Fig. 2.1: A nano-composite is combination of Nano-particles (shown by yellow arrow) and nano-clusters (shown by green arrow). A nanometer is 1/1000 of a micron. This type of composite is perfect both for anterior and posterior fillings

Chapter 3

Compomers

Compomer was first introduced in 1993 by Dentsply when their product "Dyract™" was launched. It was invented by the research team of Dentsply and was adopted by rest of the manufacturers. Compomer is derived from two words "Compo-Site" and "Iono-Mer" and is the combination of composite and ionomer technologies.

Compomer is a layman's term, better scientific version should be "Poly acid modified composite". Since it is a composite which inherits the properties of glass-ionomer such as self adhesion and fluoride ions release.

In case of ionomer cements, water which is essential for acid-base reaction, is derived from the water available in glass-ionomer liquid and therefore the acid-base reaction starts as soon as dry powder is mixed with water containing liquid. But in the case of compomer which is anhydrous the acid-base reaction starts only when the light-cured compomer is exposed to moisture in the oral cavity. This reaction is possible due to polymerizable acidic monomers present in compomers.

The older version of "Dyrect™" has been recently improved by reducing the size of the particle of the filters. The original matrix has also been modified by adding cross-link monomers. These modifications in new product "Dyract AP™" gives greater strength, increased wear resistance and higher fluoride release. The compressive, tensile strength and wear resistance of "Dyract AP™" is similar to small particle hybrid composite, which makes it suitable for all types of restorations specially to suit high caries risk patients and children.

BRANDS

The brands of compomers available are:

i. Compoglass™ (Ivoclar)
ii. Hiytac™ (Esp)

iii. F-2000 (3M Corp)
iv. Elan (Kerr)
v. Dyract AP™ (Dentsply).

All restorative materials which are cured by polymerization, shrink during curing process. Average filled composite shrink on an average of 2 to 4 per cent, packable composites, however, shrink about 1.8 to 2.2 per cent because of their higher filler contents. Studies done on improved compomers show that the polymerization shrinkage is compensated by the hydrophilic expansion of the compomer through water uptake from the saliva. The net volume change in "Dyract AP™" was found after 3 months to be equal to 0.5 per cent as compared to 2 per cent shrinkage in an average composite material.

Doubtlessly, the water is absorbed by compomers, but there is, however, no loss of its mechanical properties, because of the continuous acid-base reaction. This increases marginal integrity of the product and it is probably the reason for less postoperative sensitivity and reduced secondary caries due to continuous release of "Fluoride".

INDICATIONS

Compomers are indicated especially in class V cervical cavities. All types of restorations in children, class III cavities, small class I and class II cavities, root caries, high caries risk patients and where fluoride release property of compomer would be beneficial.

CONTRAINDICATIONS

It is contraindicated in high stress bearing situation like large class II and IV restorations, where composite is still a better choice, inspite of all the improved properties of compomer.

CHAPTER 4

Non-rinse Conditioners (NRC) Self-etching Primers

No doubt compomers can be used directly only after applying the primer/adhesive but when it is to be bonded to enamel especially in stress bearing areas of class I, II and class IV situations, conditioning of the enamel should be done by total etch technique. This conditioning is done with 37 per cent phosphoric acid etchant gel, which must be rinsed off by air-water jet. This area then requires re-isolation of the tooth without saliva contamination. This re-isolation should be performed under high speed suction.

To reduce this time consuming and technique sensitive method of air-water jet washing and then re-drying the tooth and again re-isolation of tooth without being contaminated, to avoid all these procedures a new method of non-rinse conditioner (NRC) similar to self etching primer has been developed.

The NRC is applied to both the enamel and dentine surfaces and left undisturbed for 20 seconds. After 20 second the excess of NRC is removed by air syringing without desiccating the tooth. After application the NRC penetrates and incorporates into the smear layer, rather than removing it completely as in total etch technique. At present NRC is used only with compomers. This is very useful technique for children where rinsing and changing of cotton rolls is difficult and chance of saliva contamination is greater.

CHAPTER 5

Flowable Composites and Compomers

In restorative dentistry it was realized that a less viscous material should also be available, which could flow easily into nooks, corners and angles of the cavity without creating any voids, air bubbles, etc. and should thoroughly wet the cavity floor. The material should also seal small class I, class II, and class V cavities efficiently in contrast to normal viscous material.

Kerr was first to develop a flowable composite and marketed it under the brand name "Revolution™". Soon many other manufacturers developed flowable composite as under:

i. Tetric Flow® (Ivoclar, vivadent)
ii. Renamel Flow™ (Cosmodent)
iii. Aclit flow™ (Bisco).

COMPOSITION

In all of them basically monomer matrix contains Bis-GMA, urethane dimethylacrylate and triethylene glycol dimethacryate. The inorganic filler particles are barium glass ytterbium trifluoride, Ba-Al fluorosilicate glass, highly dispersed silicon dioxide and spheriod mixed oxide (68% by wt.) catalysts, stabilizers and pigments are additional contents (0.4% by wt.).

The filler quantity is 64 to 68 per cent by wt. and 40 to 44 per cent by vol. with particle size between 0.04 and 3.0 μm (mean particle size is 0.7 μm). The major use of flowable resin would be to form a good marginal seal at the gingival box of class II restoration. A flowable compomer with properties of self adhesion and continuous fluoride release would be a preferred advantage as compared to composite. Its fluoride release property will be a boom in children and high caries risk individuals. The following product of flowable compomer are commercially available.

i. Dyract flow™ (Dentsply)
ii. Compoglass flow™ (Ivoclar).

Tuberculin syringe delivery and better curing without porosity is an edge of Dyract flow™ over Compoglass flow™.

INDICATIONS

The indications for the use of flowable materials are:

i. Class V restorations (cervical caries/root erosions)
ii. Sealing proximal box of class II cavities near gingiva.
iii. Small class III restorations.
iv. Small class I cavities as sealant.
v. Blocking undercuts in inlay, onlay and crown preparations.
vi. As first increment in all deep restorations to avoid voids/porosities and to obtain a good seal to prevent post-filling sensitivity.
vii. Preventive resin restorations in premolars and molars.
viii. Adhesive cementation of composite/ceramic veneer.
ix. Repairs of composite/ceramic veneers.
x. Adhesive cementation of ceramic and composite restorations.

CONTRAINDICATIONS

i. Covering of surface of large restorations because of its less wear resistance.
ii. Where dry field is not possible to achieve.
iii. Where patient is allergic to any of the ingredients of the material.

CHAPTER 6

Composite for Posterior Teeth (Molars)

The advancement in the field of submicron hybrid composites, e.g. "TPH spectrum™" or much better packable composites like "surefil™" with increased wear resistance and greater comprehensive and tensile strength, along with the introduction of nano-scale filled hydrophilic dentine bonding agents like Prime and Bond NT™, this combination has made posterior teeth (molars) filling very popular because of technically acceptability and matching colour.

INDICATIONS FOR POSTERIOR TEETH (MOLARS) FILLINGS BY COMPOSITE

1. All class I and class II cavities.
2. Patients sensitive or allergic to mercury.
3. Patients demanding aesthetics even in posterior teeth.
4. Patients who are afraid of mercury toxicity.

CONTRAINDICATIONS

1. Where moisture control is not possible.
2. Where proximal step of class II cavity is below gingival margin. In such condition it is not only difficult to manipulate placement of composite, but also moisture from gingival tissue is difficult to control.
3. If lack of time is a factor.
4. If cost of the filling is a factor.

CHAPTER 7

Compulsory Steps in Successful Bonding

1. *Shade determination:* Clean the tooth before determining the shade. The tooth should be still moist for shade determination.
2. *Cavity preparation:* Prepare the cavity according to the principles of the adhesive technique, i.e. gentle treatment of the tooth structure. In class II gingival box area do not injure gingiva otherwise it may bleed or ooze which will be difficult to control. Do not prepare any sharp internal edges or additional undercuts in caries free area, i.e. it is not mandatory to follow G.V. Black's principles as in cavity preparation for amalgam. In anterior regions, bevel the enamel edges. Caries free cervical defects are not prepared, but merely cleaned with pumice and a suitable clearing paste or water using a rubber cup or a rotary brush. After that, remove possible residue with waterspray and clean the cavity. ***No oil or oily material should ever be used, because no bonding material, bond to oily or dirty plaqued surface of the tooth.***
3. *Isolation:* Appropriate isolation of the tooth with cotton rolls with heavy suction or ideally with a rubber-dam is required.
4. *Base/pulp protection:* If an enamel/dentine bonding agent is used, a base material is not required. Cover the areas close to the pulp in floor of the cavity in "dots" like fashion with a calcium hydroxide material. And in very deep cavities calcium hydroxide layer should be covered with a pressure resistant cement, e.g. a glass ionomer cement or a zinc phosphate cement. Do not cover the remaining cavity walls, use these surfaces for bonding with an enamel/dentine adhesive. Do not use oil based cements like zinc-oxide, eugenol, etc. as no bonding is ever possible on any oily surface.

5. *Fix the matrix/inter-dental wedge:* Use a transparent matrix band preferably without a clamp for cavities affecting the proximal areas.
6. *Conditioning/application of bonding agent:* Condition the cavity/tooth with "Total etch" technique using 34 to 37 per cent phosphoric acid etchant gel as per recommendations of the manufacturer. Normally it is applied for 15 seconds (not more than 20 seconds) lest it should denature the surface dentine causing a collapse of its collagen fibres resulting in a week bonding to the dentine.
7. *Wash off the etchant gel:* With an air/water pressure spray for about 5 to 10 seconds.
8. *Remove the excess water:* From the tooth surface with an air syringe for 1 second/ or blot dry with an applicator tip or cotton pellet taking care that you do not desiccate (dry) the surface. It is essential to keep the dentine slightly moist. Moisture is required for diffusion of the hydrophilic resin of the primer into the collagen fibres. Moisture also saves collagen fibres against collapse.
   Note: It is sometimes better to first apply the etchant gel to only enamel part of the cavity in the first installment sparing the deeper dentine part, leave it for 15 seconds undisturbed and then spread afresh etchant gel into the whole cavity including dentine for another 15 seconds. Reason being that enamel tolerates etchant better than dentine.
   But in no case dentine should be etched for more than 15 seconds.
9. *Researches have proved:* that the results of one bottle adhesive is as good as primer and bonding materials in two separate bottles.

a. Take the Prime and Bond NT™/Optibond soloplus directly on applicator tip or put two drops of prime and bond in a dappen dish and apply the adhesive freely over the cavity area with a small brush wetting the surfaces thoroughly well.
b. Leave undisturbed for 20 seconds.
c. After 20 seconds remove excess solvent by air syringing for a second or two (Air thinning).
d. Light-cure by good reliable light for 10 to 20 seconds. Inspect for perfect 'glossy' base and walls. If 'matt', i.e. hazy like areas are present it indicates insufficient application of adhesive, repeat the application of the adhesive and cure all the 'matt', i.e. hazy areas till they also become glossy and no 'matt' areas are left. This step shall give perfect sealed interface between loading composite and bonding material and thus shall avoid any future development of pulp sensitivity.

10. *Use incremental technique:* for placement of composite each increment of about 2 mm (except in case of Surefil™ where increment may be of 5 mm because Surefil™ can be cured upto a depth of 5 mm at a time). Light-cure each increment separately for 40 seconds keeping the light-cure machine's light emersion window as close to the restorative material as possible.

The first increment may be of "Compomer" or better with a flowable compomer or composite for release of fluoride and a better flow to avoid voids, air bubbles and better adaptation in nooks and corners of the cavity. It will also act as "stress breaker" for the normal filled rigid loading composite layers above it. ***Keep in mind that this layer of flowable material should not***

be of more than 0.5 mm or so and of course it should also be thoroughly light-cured for 60 seconds (See figs 7 to 21). The flowable material in a restoration occupies the total base area of the cavity, whereas the regular filled material is filled over this layer, taking its bonding strength from flowable material base and bonding tentacles from the inner walls of the cavity.

Now, if a thin layer of flowable material is applied then it will just allow very little elastic compression space under the occlusal stresses on the regular filled material over it and shall act as favourable "Stress breaker". But if a thick layer (more than 0.5 mm or so) of the flowable material is applied, then it will have more elastic compression space (spring action) under the regular filled material, which in turn shall break its only weak tentacle support of the sides and shall collapse over the base of the flowable material to which it is bonded below and the filling will break and come out.

That is why it is very important to give only 0.5 mm or so (thin) base layer of flowable material, so that restoration may not collapse under occlusal stresses.

11. *In the last occlusal layers:* contour the increment, when it is still copious to maintain the occlusal and cuspal anatomy and then light-cure it for 50 to 60 seconds. The first deeper layer near the floor of the cavity should be light-cured a little longer, i.e. 50 to 60 seconds for complete/better polymerization of the martial to avoid development of any future sensitivity of the pulp.

    Also the last increment near the occlusal surface should also be light-cured for 50 to 60 seconds for better curing resulting into a better wear resistance.

12. *After correcting:* the filling for any excess and also checking the proximal contacts rubber-dam or cotton rolls should be removed. The occlusal relationship with the opposite teeth should be corrected next with the help of articulating papers and grinding of the excess material by appropriate finishing diamond under low speed and light pressure to avoid overheating/charring of the composite. After attaining perfect occlusion in centric occlusal position (Static) and lateral excursions (Dynamic) final polishing should be started.

TECHNIQUES FOR POLISHING THE COMPOSITE FILLING MATERIAL

1. Start with 12 bladed carbide bur under low speed and very light pressure without water spray for better view, burs 7103, 7714, 7406, 7214, 7642 (Dentsply) may be used. Wet finishing obscures the view and sometimes results in ditching the cementum at gingival margins.
2. Enhance™ Sol-Lex™ or polishing kit by 3M, KENDA, etc. are very good polishing kits. The advantage of Enhance ™ is that only one grit is needed to smooth the surface rather than changing of grits in other systems.
3. For final polish Prisma Gloss™ (aluminous oxide) is good with a rubber cup or synthetic foam-polishing cup supplied with the paste pack.
4. ***Never overheat composite use low speed and light pressure.***
5. A well polished surface lasts longer as it attracts less plaque and shall have better wear resistance.

Summary of Filling Steps with Composite

1. *Shade determination:* In moist and in very start.
2. *Prepare cavity:* As per principle of cavity preparation protocol.
3. *Isolation:* Cotton rolls with high suction or ideally rubber-dam.
4. *Base protection:* In deep cavities with Dycal™ (calcium hydroxide paste).
5. *Fix Matrix band:* Use interdental wedges.
6. *Conditioning:* Total etch 37 per cent phosphoric acid for 15 seconds.
7. *Wash etchant:* For 5 to 10 seconds with air-water spray.
8. *Remove excess water:* Leave some moisture.
9. *Apply adhesive/primer:* Freely by brush tip and leave undisturbed for 20 seconds.
10. *Remove excess solvent after 20 seconds:* With air syringe for 1 to 2 seconds without moisture or water (Air thinning).
11. *Light-cure for:* 10 to 20 seconds. Inspect for "Matt" like areas (unglossy surface). If present repeat this steps in that area till glossy surface is achieved.
12. *Use increment:* Of 2 mm each and light-cure them separately for 40 seconds.
13. *If using flowable composite/compomer:* First increment film should be thin of about 0.5 mm or so and light-cure for 50 to 60 seconds.
14. *Contour last occlusal layers:* To replace surface anatomy of the tooth and light-cure for 50 to 60 seconds.
15. *Remove high points:* With the help of articulating paper in centric occlusion position (Static) and in lateral excursions (Dynamic).

16. *Polish as per protocol:*

The photographs from Figures 7.1 to 7.20 are of a clinical case. A step by step presentation of replacement of old defective amalgam filling in teeth 15-16, which were replaced by light-cure composite filling using flowable material for the base, i.e. first layer (Figs 7.14, 7.15 and 7.21) followed by filling of the rest of the cavity by a micro-filled light-cure composite material (Figs 7.16 to 7.18).

i. The polishing kit is shown in Fig. 7.22.
ii. Another "composite filling" case is also shown in the following diagrams (Figs 7.23 to 7.25).
iii. Different restorations class III and class I by Beautifil™ (Shofu Inc.) (Figs 7.26 to 7.31).
iv. A case of decayed 45 (Distal) restored by iBond is shown in Figures 7.32 to 7.38.
v. Deep pit and fissure sealing by ultra seal X.T. plus™ (Ultradent) is shown in Figures 7.39 to 7.44.
vi. A glass-ionomer coating for the early protection of erupting molars (Figs 7.45 to 7.46).

Fig. 7.1: Initial situation: defective amalgam fillings in teeth 15 and 16

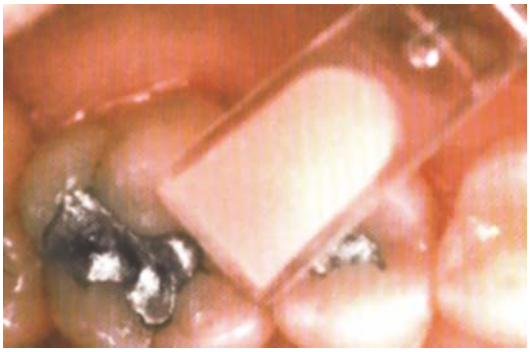

Fig. 7.2: Shade selection with the shade guide of the restorative system

Fig. 7.3: Situation after removal of the amalgam fillings and initial preparation

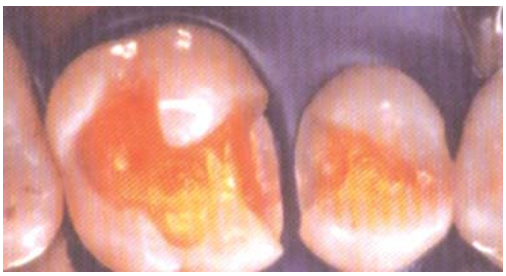

Fig. 7.4: After excavation both cavities were finished. The cavities are completely surrounded by enamel

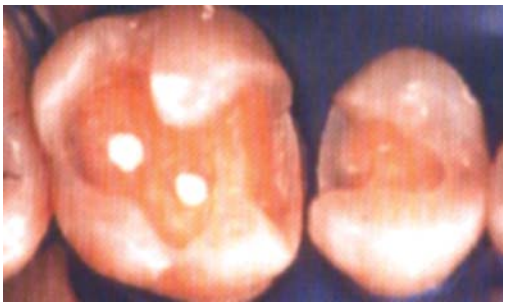

Fig. 7.5: Covering of areas close to the pulp on tooth 16 with calcium hydroxide (Dycal™) in dot like fashion covering minimum area and leaving maximum area for bonding

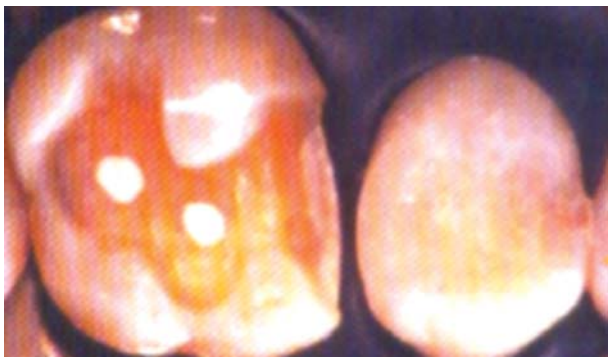

Fig. 7.6: Situation after restoration of the second premolar with light-cure composite

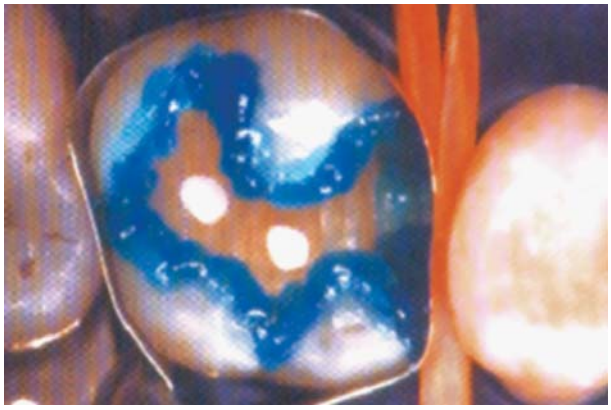

Fig. 7.7: Application of 37 per cent phosphoric acid initially to the enamel margins only. Sparing dentine surface

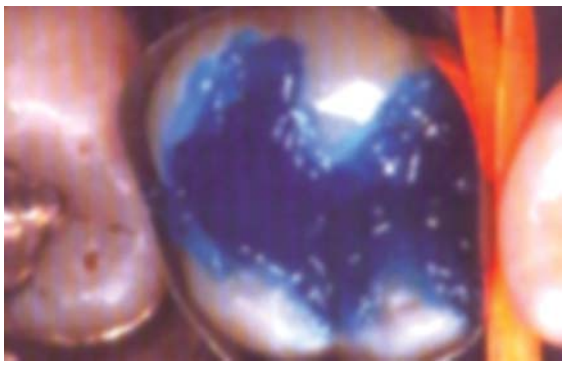

Fig. 7.8: After 15 seconds of enamel conditioning, filling the entire cavity with etchant and conditioning the enamel and dentine for another 15 seconds (total etch)

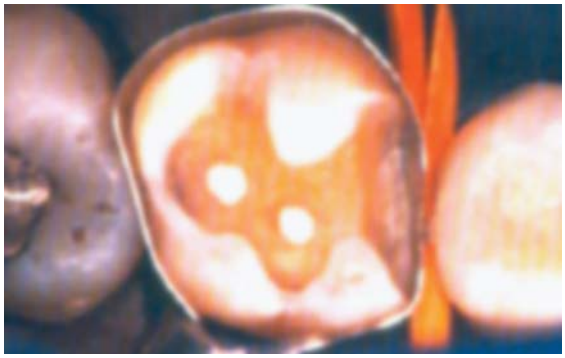

Fig. 7.9: The typical chalky-white appearance of successful enamel etching

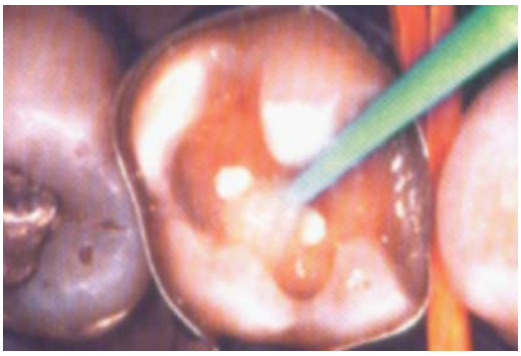

Fig. 7.10: Application of the adhesive Prime and Bond NT ™ with micro-brush to enamel and dentine

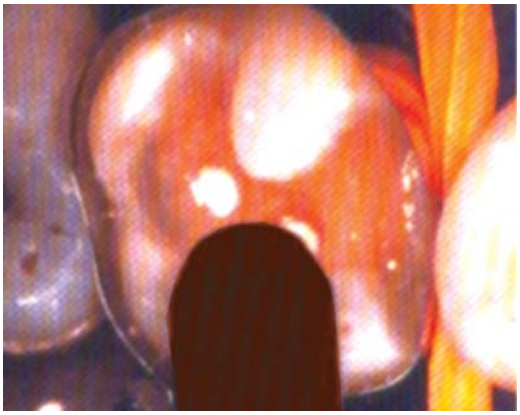

Fig. 7.11: Careful evaporation of the excess solvent from the adhesive system after 20 seconds—(air thinning)

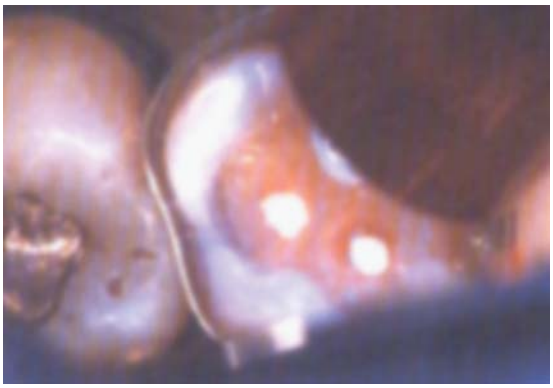

Fig. 7.12: Light-curing of the adhesive for 20 seconds

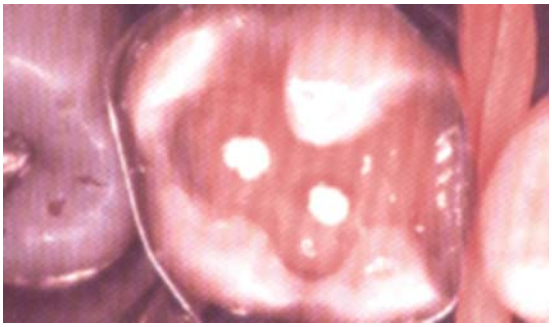

Fig. 7.13: The adhesive shows a glossy surface on the entire cavity. No “matt” areas noticed

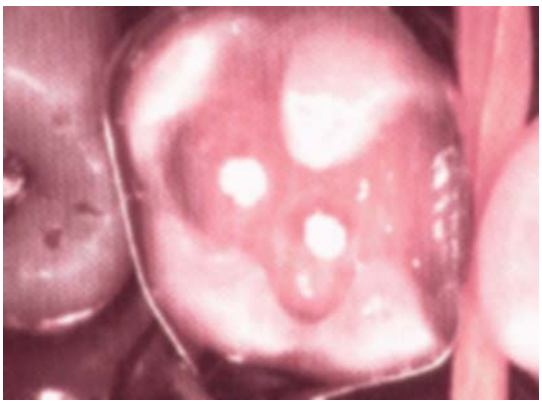

Fig. 7.14: Application of a layer of flowable material, Tetric flow as “stress-breaker”

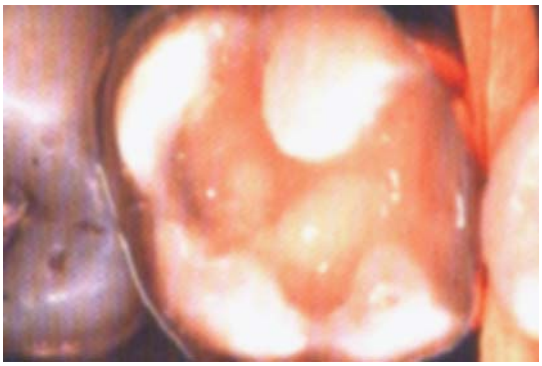

Fig. 7.15: A thin layer (0.5 mm) is important light-cure for 40 seconds

Fig. 7.16: Re-contouring of the matrix and application of a first layer 2 mm of the light-cure composite restorative material. Light-cure for 40 seconds

Fig. 7.17: Situation after incremental build-up of the filling

Fig. 7.18: First check of the occlusion after removing cotton rolls/rubber-dam

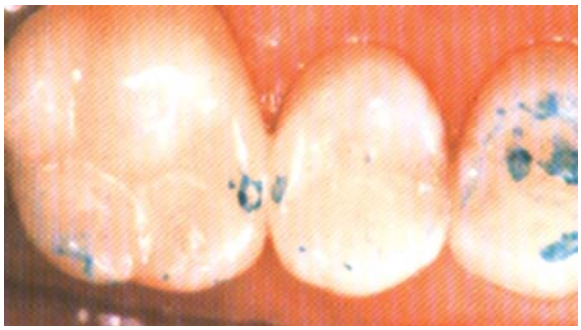

Fig. 7.19: Second check of static and dynamic occlusion after finishing and pre-polishing of both fillings

Fig. 7.20: Finished restoration re-establishing the initial shape of the teeth and adapting its shade well to the surrounding tooth substance

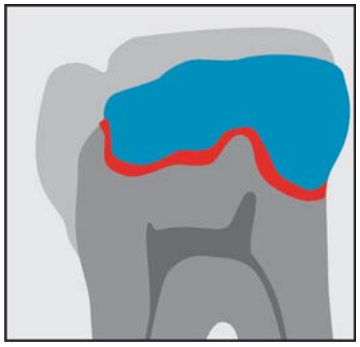

Fig. 7.21: Thin 0.5 mm layer of flowable material should be used. Red area is the layer of flow able material, whereas blue area is the area of regular composite material

Fig. 7.22: Polishing kit

i. Polish with white-coarse grit until correct form and a smooth surface achieved
ii. Polish with green which gives smooth and silky surface
iii. Polish with pink fine grit, a high gloss and finest surface are instantly achieved

Fig. 7.23: Etch

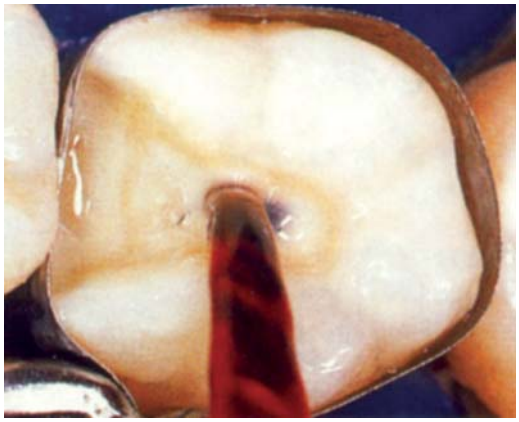

Fig. 7.24: Bond: Syringe deliver PQ1 (Ultradent) directly into preparation with Inspiral Brush Tip, air thin and light-cure

Fig. 7.25: Restore. Finished restoration

Fig. 7.26: Before

Fig. 7.27: After

Fig. 7.28: Before

Fig. 7.29: After

Fig. 7.30: Before

Fig. 7.31: After

Filled by “Beautifil” (Shofu Inc.)

Fig. 7.32: The decay is noted on the distal surface of 45

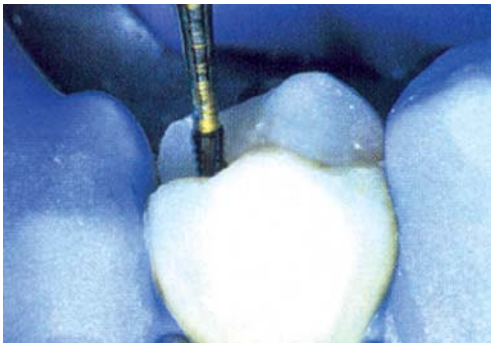

Fig. 7.33: The decay is accessed and removed with bur

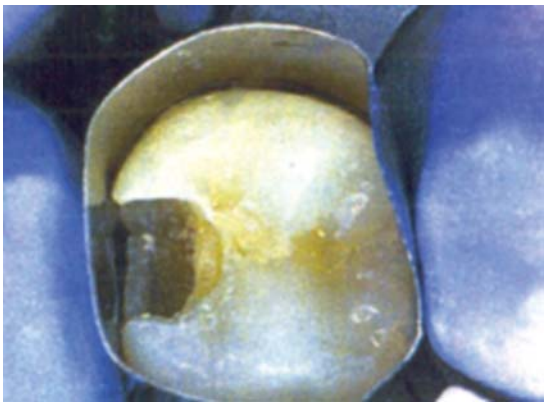

Fig. 7.34: The conservative cavity preparation is complete. The tooth is matrixed

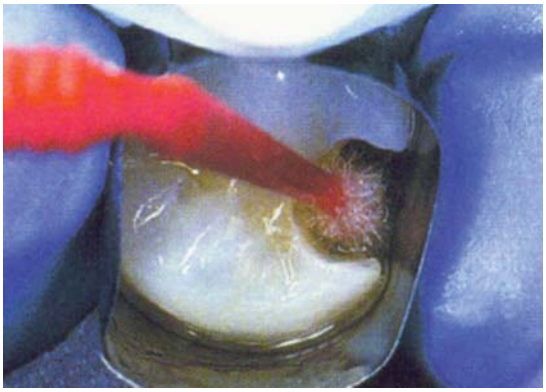

Fig. 7.35: The preparation is bonded with iBond (Heracus Kulzer)

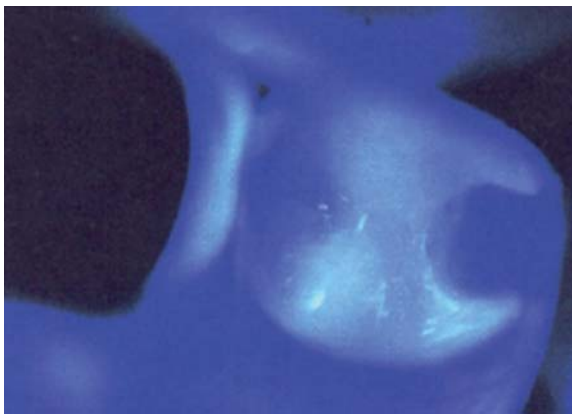

Fig. 7.36: The bonding agent is light-cured

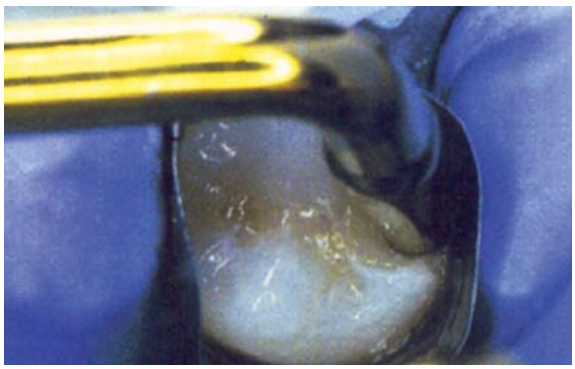

Fig. 7.37: The cavity is restored with Venus (Kulzer)

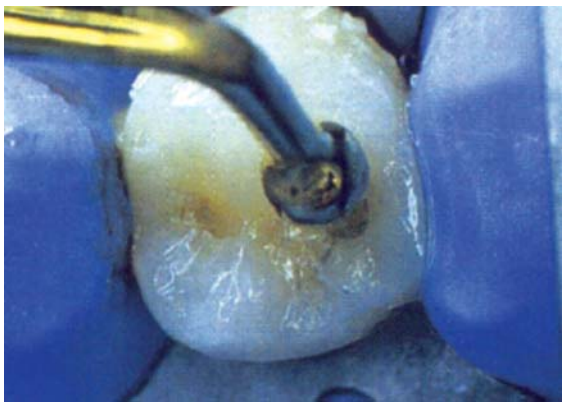

Fig. 7.38: The occlusal surface is pre-shaped with duck-head instrument and light-cured finished and polished

Fig. 7.39: Before

Fig. 7.40: Etch

Fig. 7.41: Dry & Prime

Fig. 7.42: Seal

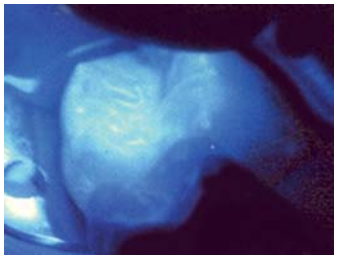

Fig. 7.43: Cure

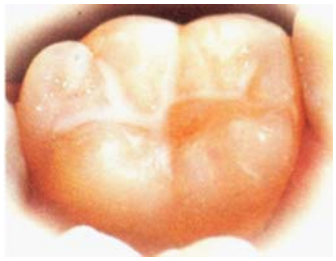

Fig. 7.44: After

Figs 7.39 to 7.44: Ultra seal X.T. plus™ (Ultradent) is a fluoride releasing quality, predictable, easy to use as pit and fissure sealent

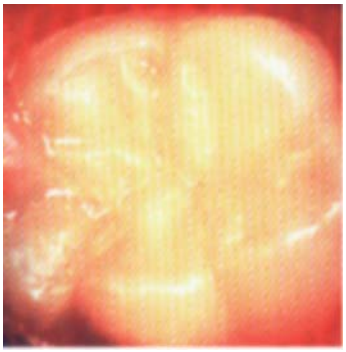

Fig. 7.45: Before

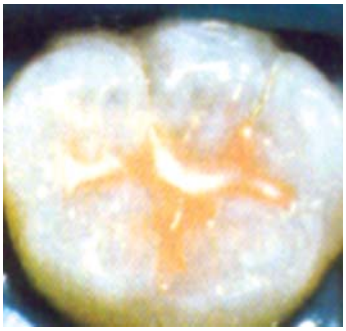

Fig. 7.46: After

Figs 7.45 and 7.46: A case of glass ionomer coating (Pink) for the early protection of erupting molar with GC fugi VII resin free glass ionomer self set it just cures in 20 to 40 seconds bonds in moisture, can also be applied quickly and easily to coat and occlude pits fissures and tooth surfaces. It releases very high level of fluoride and can easily be distinguished because of its “Pink colour”

CHAPTER 8

Restoration of a Fractured Incisor (Class IV Defect)

The decision should be made between selection of repair of large class IV defect either by bonding or by full facial veneer. The veneer, however, does not have more strength than bonding, but in most of the cases necessary for aesthetic reasons.

Bonding, though a conservative method of restoring tooth, some preparations are necessary for optimum results. Restoration should not only be pleasant looking, but also functionally correct to resist the occlusal forces. Hence the operator must be well acquainted with the principles of occlusion. Bruxism being a major hazard and is contraindication for a direct composite veneer, however, if unavoidable then occlusal nightguard must be provided to the patients.

Because mandibular incisors glide on the palatal surface of the maxillary incisors during protrusion it is important that any abnormal forces during protrusive phase may fracture the restoration, if improperly contoured.

1. *Preparation of the tooth:* Old restoration and caries should be removed. Make a chamber of about 0.25 or 0.3 mm deep of about 3 to 4 mm width along round the whole periphery. Now place a long bevel up to crest of the gingiva from mesial to distal direction.
2. *Selection of shade:* Both enamel and dentine shades should be selected. The dentine replacement material is placed as strong and opaque base to prevent shine through.

   Enamel replacement material is generally more translucent. If properly selected, composite shades, eliminates need for opaquers. Opaquers should be avoided as far as possible because of their shine through enamel shades produce unaesthetic looks.
3. *Abutments:* At this stage tooth should also be checked for any proximal caries, because it is the best time to

restore them because of easy approach from proximal side, over hanging or over contoured restorations if any, may be contoured conveniently at this juncture.

4. *Removal of the stains etc:* Any debris or stains should now be removed with a coarse stone or bur.
5. *Protection of pulp:* If properly sealed with bonding material protection of the pulp is not required. If, however, very thin covering of dentine is suspected then it should be covered with quick setting calcium hydroxide liner like Dycal™. ***It is mandatory to cover this layer of Dycal™ with flowable compomer for final aesthetic reasons otherwise the shade of Dycal™ will be apparent under translucent composite enamel replacement material.***
6. *Etching the preparation:* Etching may be done with 37 per cent phosphoric acid gel. Abutments should be protected by mylar strips whereas tooth should be etched a little past the bevel.
7. *Apply adhesive:* Now apply the adhesive and light-cure it after elapse of 20 seconds for 10 seconds. The resultant shining area should be checked and reapplication of adhesive and curing should be done if "matt" (hazy) areas are left behind till total adhesive area should become glossy (these matt areas where bonding shall not be perfect will be the potential sources of postoperative sensitivity of the tooth).
8. *Matrix bands:* Generally they are not required as the composite if sculptable and does not slump, it is possible to complete the entire restoration without a matrix. Mylar strips, however, may be used if deemed necessary to safeguard abutments.
9. *First build the lingual shelf:* The lingual shelf should be built first with opacious shade of composite (already

preselected). Lingual shelf should cover the entire lingual portion and should also be sculpted into Chamfer area of the facial side. In most of the cases this step will result in opaquing out the shine through of the dark background.

10. *Facial buildup:* It should be done in two shades and two layers, if necessary. The first layer is the body shade which is contoured up towards the incisal area in a scalloped fashion. This is then light-cured for 40 seconds. Then the translucent incisal shade is placed on the incisal edge from mesial to distal side and feathered into the body of the tooth and light-cured. This step would result into slightly over contouring of the restoration.
11. *Contouring and polishing the restoration:* First the incisal edge should be reduced to proper length . Next contour the lingual surface with finishing burs without water to enable better visualization of the margins and the developing anatomy. The occlusion can now be checked and adjusted.

    The facial finish is now started with 12 bladed finishing bur (7714 dentsply) paying special attention to the resin interface. Do not over finish lest it should result into a "white line". If white line do appears then slowly smooth the transition from resin to the tooth till the white line disappears. Finishing discs are of particular help in achieving this and preventing scaring of the tooth. The final gloss is achieved by Prisma Gloss™ and Prisma Gloss extrafine ™ paste and rubber cups or foam cups, etc.

Diagrammatic representation of :

i. How to change 13 into missing 12 is shown in Figures 8.14 to 8.17.

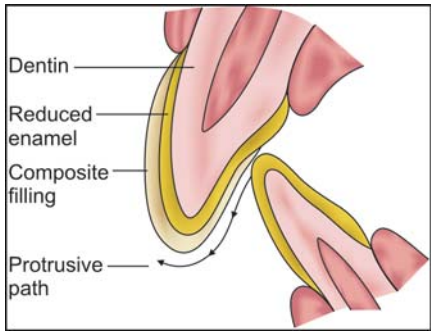

Fig. 8.1: The mandibular incisor path as it transverses during protrusive phase along the palatal surface of upper incisor

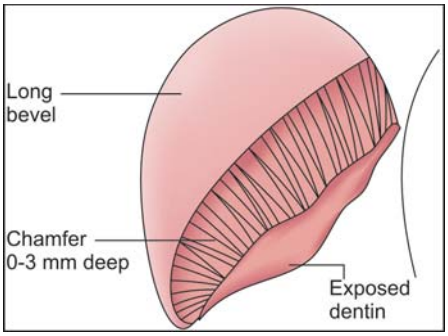

Fig. 8.2: Diagrammatic representation of preparation of a fractured incisor

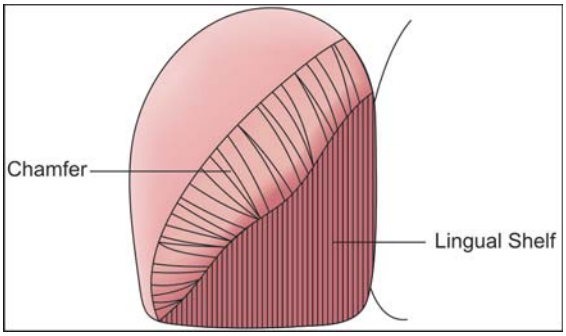

Fig. 8.3: Lingual shelf is made of opaque composite being spreaded partly overlapping labial chamfer

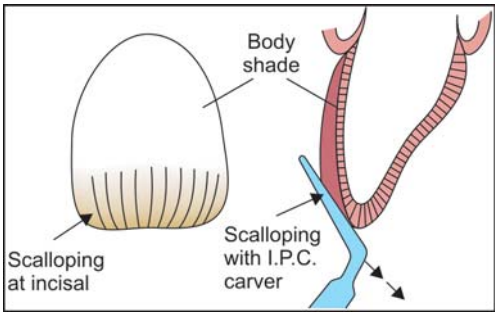

Fig. 8.4: Layering of body shade is done with "pre-selected shade" composite and light-cured for 40 second for each layer

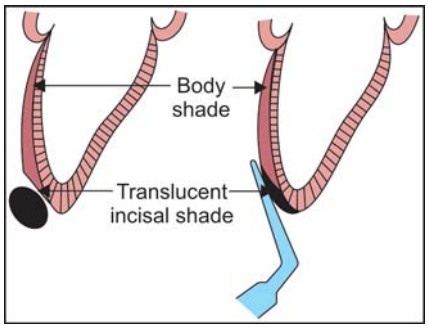

Fig. 8.5: Apply and blend incisal (transparent) shade into body shade and light-cure for final results after polishing

Fig. 8.6: Fractured central incisors before direct bondings

Fig. 8.7: Fractured central incisors restored

Fig. 8.8: Diastema, small spaced incisors which required aesthetic improvement

Fig. 8.9: After direct micro hybrid composite (TPH Spectrum™, Dentsply) bonding (See Chapter 9 for details)

Fig. 8.10: Smile before direct bondings

Fig. 8.11: Smile after direct bondings

Fig. 8.12: Discoloured, abraded old restorations which require aesthetic direct bondings

Fig. 8.13: Old restorations completely removed and replaced with full veneers on centrals and laterals. Prime and Bond NT™ and micro hybrid TPH Spectrum™ were used for bonding the veneers

Fig. 8.14: Clinical findings: anterior teeth of upper jaw on right-hand side of a 28 years-old patient with missing lateral incisor

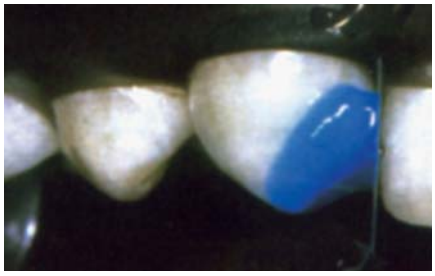

Fig. 8.15: The area was isolated with rubber dam. After the enamel surface was roughened slightly, etching of the adhesive surface was carried out with ortho-phosphoric acid gel

Fig. 8.16: An opaque dentine core was built up with the shade A3D on 13

Fig. 8.17: The final picture shows change of canine into lateral incisor

ii. Incisal 1/3rd of 21 restored with bonding with composite in a vital tooth (Figs 8.18, 8.19, 8.22 and 8.23).
iii. Incisal 1/3rd of 21 restored with bonding with composite in non-vital tooth (Figs 8.20 and 8.21). (endotontically treated)
iv. Heavy fluorosis of vital 11 and 21 treated by bleaching and composite bonding, 12 and 22 were left for comparison (Figs 8.24 and 8.25).
v. A case of tetracycline stains cervical 1/3rd of 11 and 21 (21 Non-vital) treated by bleaching and bonding with composite (Figs 8.26 and 8.27).
vi. A case of fluorosis treated by composite lamination (Figs 8.28 and 8.31).

Fig. 8.18: Situation before (Vital 21)

Fig. 8.19: Situation after bonding 21 with composite

Fig. 8.20: Situation before (Non-vital 21)

Fig. 8.21: Situation after bonding 21with composite

Fig. 8.22: Incisal edge fracture in 11

Fig. 8.23: Incisal edge repaired by composite

Fig. 8.24: Heavy brown discolouration (fluorosis) in the teeth 11, 12, 21-22

Fig. 8.25: Stains of fluorosis cleaned by grinding and bleaching from 11 and 12 laminated with composite and polished. Note the difference in look comparing with 12-22 (Initial situation)

Fig. 8.26: Brown stains "tetracycline" in cervical of 1/3rd of 11 and 21 (21 being non-vital)

Fig. 8.27: Tetracycline stains completely covered by bleaching followed by composite lamination (Slight dark hue of 21 is due to Non-vital discolouration)

Fig. 8.28: A case of heavy fluorosis

Fig. 8.29: Treated by bleaching, micro-abrasions and composite lamination

Fig. 8.30: Brown stains "Fluorosis".
Note: Distinct lines showing age and the time of deposit of stain

Fig. 8.31: Typical "Khat stains". (A rare case.). A habitual chewing of khat leaves will leave yellowish-brown discoloration of fluorosis probably due to deposition of tannin found in the leaves. (Khat leaves from "Yaman" contains 360 ppm fluoride)

Chapter 9

Diastema Closure

Closing of the diastema with composites can immediately and dramatically change the beauty of the smile just in a single appointment. It may also help to improve speech and food particles being caught in the space between the teeth.

The ratio between length and width of incisors teeth is about 10:8, so first step would be to measure the dimensions of the incisors where diastema is to be eradicated.

If the space between incisors (diastema) is less than 3 mm it can be categorized as "simple diastema". If, however, the space is more than 3 mm then the problem of shine through the two incisors would be too big to look natural, hence the condition shall be tackled by "complex diastema " closure technique.

Simple diastema closure: can easily be done by simply adding composite on both effected sides of the incisors (abutments).

Complex diastema closure: If the gap is more than 3 mm, then the diastema is closed as in simple diastema closure but to compensate the increased width of the tooth opposite side; the tooth is also reduced to maintain the basic length-width ratio of 10:8. Now the so created diastema on distal side of the tooth can be closed by simple diastema closure technique on the mesial side of the abutment of the primarily effected tooth. For example, if there is diastema of more than 3 mm between two central incisors the reduction of increased width of central incisor is compensated by reduction on its distal side till the ratio of 10:8 is maintained.

Now diastema so created between central and lateral incisors can be filled by adding composite on the mesial side of the lateral incisor. This complex diastema closure

technique may have to be combined with full facial veneer sometimes.

STEPS IN CLOSURE OF DIASTEMA

1. *Measure the space (diastema) and plan for choosing simple or complex closure techniques.*
2. *Select the shades*
3. *Preparation of the tooth:* For simple closure no preparation is required. Check the tooth for stains and remove them if present. Remove tooth material from the distal side in complex cases to main 10:8 ratio of length-width of the tooth. It should be done without local anaesthesia and without exposure of the dentine, lest it should become sensitive tooth later. Start with a single tooth first and complete the procedure up to final polishing, before starting the next tooth.
4. *Etch the tooth:* Etch the surface of the tooth for 15 seconds on mesial, facial and lingual/palatal side with 37 per cent phosphoric acid etchant gel, use mylar strips to avoid etching of the abutments. The restoration should cover up to one-third of facial and lingual or palatal side of the tooth.
5. *Wash the etchant gel:* With air/water spray for 5 to 10 seconds and blot dry the tooth.
6. *Adhesive application:* Apply adhesive as per protocol for 20 seconds avoiding contamination of the adjacent tooth. Light-cure for 10 seconds.
7. *Filling the gap (diastema):*

Simple Diastema: Inject a small amount of some microfil like hybrid from the facial side, completing the whole facial contour, check the midline before curing, light-cure for 40 seconds. Next inject second incremental layers from

palatal/lingual aspect, blending the material evenly into labial/lingual sides with proper attention to restore the tooth anatomy on diastema side. Complete contouring, curing, finishing and polishing of this restoration before starting the job on the next affected (abutment) tooth.

Repeat the steps on the next needy prepared tooth with or without using a mylar strip as composite does not stick to highly polished surface and so shall not bond to it.

For the above procedure sometimes we need immediate separation of the teeth to restore the correct mesial slope anatomy. Separation can be done with the help of a plastic instrument or a carver (Lacron's) held in the gingival embrasure between the incisors, give a twist torque force till a popping sound is heard which indicates that the teeth are seprated.

Complex Diastema: Complex diastema closure needs use of hybrid opaque composite to prevent shine through followed by use of a translucent microfil. If recent compounds like Esthet- X™ is used there is no need of a microfiller as this material comes in 31 shades selection pack. Other options of materials are: Point - 4™ (Kerr) Renew™ (Bisco) and vitalescene (Ultradent).

SUMMARY

To close a diastema decide wheather it is of simple or complex variety by measuring length and breadth of the tooth, ideal ratio is 10:8 length/breadth. More than 3 mm wide diastema is categorized as complex variety.

In complex variety preparation, reduce opposite side of the diastema side of the tooth maintaining its anatomy and length breadth ratio, reducing only in enamel. Do not expose dentine and use no local anaesthesia.

Steps

1. Measure length and breadth of the tooth.
2. Select shade.
3. Prepare the tooth remove stains, etc.
4. Etch the tooth on mesial/facial and lingual aspect beyond area of bonding after separating abutments with mylar strip.
5. Wash etchant gel from the tooth surface after 15 to 20 seconds with air-water spray for 1 to 2 seconds and blot dry, leaving some moisture for hydrophilic adhesive material to penetrate deep into hybrid area.
6. Apply adhesive material taking care not to contaminate abutment. Leave the adhesive undisturbed for 20 seconds.
7. Air blast (by air syringe) the excess solvent of adhesive material for 5 seconds. (Air thinning).
8. Light-cure for 10/20 seconds.
9. Check for glossy surface, "matt" free surface should be achieved. If "matt" surface is still present repeat the adhesive application and cure again till they also become glossy.
10. Apply microfilled composite material to build the required shape of tooth paying special attention to the midline, sculpt facial side first.
11. Light-cure each increment for 40 seconds.
12. Apply material on lingual/palatal side of the tooth and sculpt the anatomy specially on the mesial side and then light-cure for 40 seconds.
13. Add layers till perfect anatomy of the tooth is achieved.
14. Finish and polish as per protocol.
15. Repeat the same steps on the next tooth in complex diastema closure using or not using mylar strips.
    Note: In complex diastema closure use opaque layer first followed by translucent layer of composite material. But with recent microfilled materials it may not be necessary.

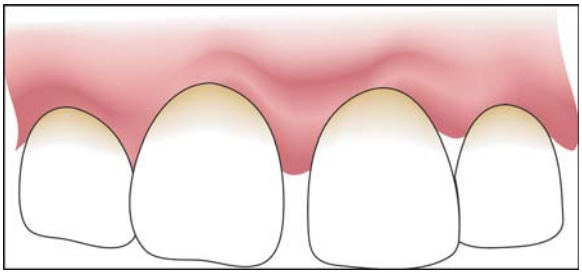

Fig. 9.1: After preparing/cleaning total etch is done by applying 37 per cent ortho-phosphoric acid up to a little past the required area for 15 to 20 sec. After 15 sec wash etchant with air-water spray

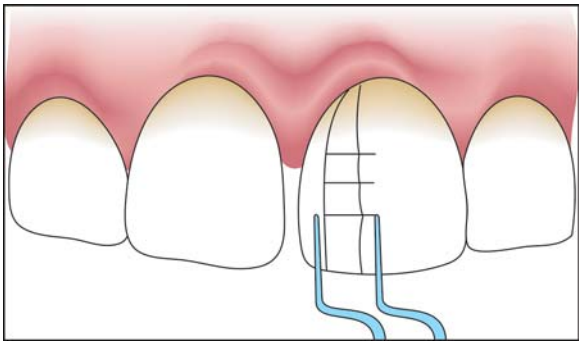

Fig. 9.2: After 'Primer' application for 20 sec. air thin and light-curing for 10 sec. preselected shade of composite is placed on proximal surface and sculpting it towards the facial surface light-cure for 40 sec

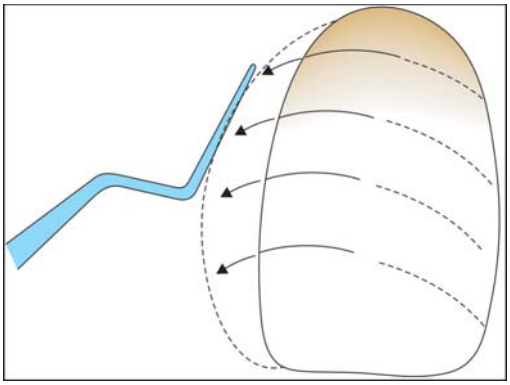

Fig. 9.3: Shows placement of composite on lingual aspect and blending it into the cured labial portion

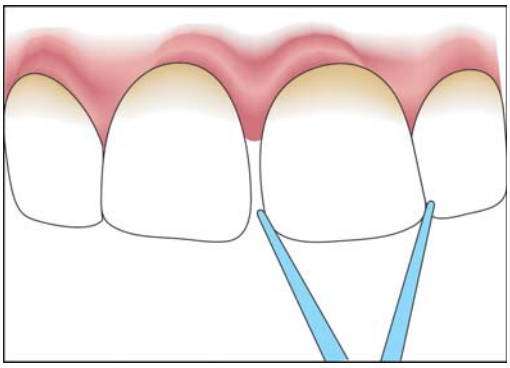

Fig. 9.4: Measure the completed restoration to make sure that the correct width is achieved as pre-determined

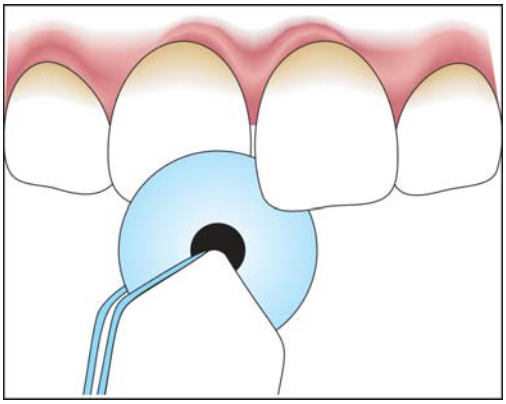

Fig. 9.5: Compo-Disc™ in use for immediate separation of bonded tooth

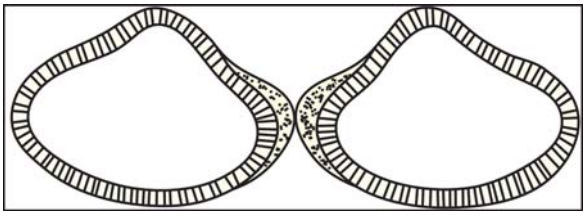

Fig. 9.6: Cross section view of incisor teeth restored to eradicate diastema

Fig. 9.7: Diastema/spaced incisors which required aesthetic improvement

Fig. 9.8: After direct micro hybrid composite (TPH Spectrum TM, Dentsply) bonding

Fig. 9.9: Diastema before direct bonding

Fig. 9.10: Closure of Diastema after direct bonding

CHAPTER 10

Bleaching of the Teeth

Hydrogen peroxide has been used as bleaching agent material since almost 100 years. It was used by dentists in their chair in high concentrations of 20 to 30 per cent by volume.

Superoxol (perhydrol): is 30 per cent sol. of H_2O_2 by wt. and 100 per cent by vol. in distilled water (H_2O_2 up to 135 per cent is also available through textile industry).

Pyrozone: is 25 per cent sol. of H_2O_2 in ether. Extreme care in it's handling should be used as it is extremely corrosive.

It was only around 1989 when "Home bleaching" with 10 to 22 per cent carbamide peroxide was introduced.

Both chairside and home bleaching systems are effective and generally lighten the colour of the teeth by 2 to 5 shades.

"IN-OFFICE" BLEACHING

Light and heat is generally used along with high concentrations of H_2O_2 (17% to 35%) researches have proved that addition of light and heat does not increase lightening of teeth shades and are not necessary for bleaching the vital teeth. On the contrary light and heat causes more pain and post-treatment sensitivity and create unnecessary complications like caustic burns of the gingiva. Some of the office bleaching products are:

i. HILITE™ (Shofu Dental)
ii. Opalescentra Xtra™ (Ultradent).

Recently Dentsply has come out with Illumine™ which contains 15 per cent H_2O_2 in an elastic putty (gel) and is held in vacuum forged tray (nightguards) which is held in oral cavity for 30 minutes or more in dentist's office. This shows greater promises because of ease of use, as compared to high concentration H_2O_2 requiring rubber-

dam for isolation of gingiva, which generally causes caustic burns inspite of all the safety measures.

"AT-HOME" BLEACHING

It is popular because of good whitening effect of teeth (2 to 5 shades) is achieved by a fortnight's use only and, of course, the safety of its use under the supervision of a dentist.

In view of increasing bleaching effect in short time manufactures tried 10 to 22 per cent of carbamide peroxide, but the fast obtained result are temporary, there is little difference in whitening of the teeth after elapse of 6 weeks, no matter whether done with 10 per cent or higher percentage of carbamide peroxide.

The thicker and stickier gel putties are considered convenient and better. Following are the popular brands:

i. Nupro gold™ (Dentsply)
ii. Opalescence™ (Ultradent)
iii. Nite-white™ (Descus Dental)
iv. Platinum™ (Colgate Palmolive) not very viscous but effective equally.

Conservative method of bleaching of the original teeth is better than more aggressive methods like veneering, crowning or bonding.

In non-vital tooth H_2O_2 percolates through the enamel and dentine to reach the pulp in few minutes time. Therefore bleaching is not only to remove superficial staining but also to remove discolouration from deeper pulpal parts.

Although the teeth shade initially may lighten, within few days, but the best results are obtained after 2 to 6 weeks which should be told to the patient in advance.

Before bleaching After bleaching

Fig. 10.1

Before bleaching After bleaching

Fig. 10.2

Before bleaching After bleaching

Fig. 10.3

Before bleaching After bleaching

Fig. 10.4

Before bleaching After bleaching

Fig. 10.5

Before bleaching After bleaching

Fig. 10.6

Before bleaching After bleaching

Fig. 10.7

Tetracycline stains take longer time to bleach, i.e. 2 to 6 months, but very dark gray or blue stains are difficult to bleach specially when they are present in gingival 1/3rd area. In such cases veneer may be required in addition to bleaching.

Most of the cases (about 60% to 70%) experience sensitivity of teeth after bleaching process. This sensitivity can be treated with toothpaste containing potassium nitrate and sodium fluoride. It should be used for topical application for 30 minutes duration, each day for several days till sensitivity is reduced.

TYPES OF STAINS THAT CAN BE BLEACHED:

i. Ageing discolouration, tea and coffee stains are easily removed.
ii. Teenagers teeth are easy to bleach and it is easy to remove stains from them.
iii. Nicotine stains are difficult to bleach.
iv. Dark gray and blue stains of tetracycline are most difficult to bleach especially in gingival 1/3rd area and may take more time.

Fifty per cent of the peroxide in bleaching agent is released in first 1 to 2 hours and the rest of it is released in next 4 to 6 hours. Hence over night bleaching is preferred to day time 1 to 2 hours bleaching.

Proper diagnosis as to the pathogenic cause of discolouration of teeth by dentist and bleaching under his supervision shall be more fruitful, than using advertised products straightaway.

ADA has approved 10 per cent carbamide peroxide as safe, reliable and effective "at home" agent for whitening of the teeth but, however, ADA has not yet allowed higher percentage of carbamide peroxide for "at home" bleaching.

CHAPTER 11

Indirect Metal Free Restorations (MFR)

Porcelain fused to metal (PFM) restorations shows a unaesthetic gray line at the gingival margins. Hiding it subgingivally may cause periodontal problems. Moreover, the presence of metal in the PFM prevents light being passing through and make these restorations look unnatural, when using gold as base recession of gingiva is unavoidable.

Recently, etching of internal surfaces of the full ceramic restorations with hydrofluoric acid and bonding them to enamel and dentine with dental adhesive and aesthetic resin cement give them a long lasting seal of cavo-surface margins with resultant better gingival health. It also increases fracture resistance of the restoration and that has been a long desire of a dentist.

PRESSABLE CERAMICS

There are many all ceramic restoration systems available but the most popular today are the pressed ceramic because of their excellent fit and marginal integrity.

i. Empress and
ii. Empress II (Ivoclar) had been in lead for last 10 to 12 years. Recently "Dentsply" Finesse all ceramic™ has been introduced with an edge over others because of its increased aesthetics, less wear of opposite teeth, easy polishability and thermal stability even after several consecutive firings. It has proved perfect for anterior and posterior full coverage, crowns veneers, inlays and onlays. This materiel is fired at low fusing temperatures which enhances the utilization of proprietary, as it is a naturally opalescent powder it would be unstable at higher temperatures. The core material as well as low fusing ceramic exhibit natural look in all lighting conditions.

SELECTION OF DENTAL ADHESIVE AND RESIN CEMENTS

Pressable ceramics can be etched from ventral side with hydrofluoric acid and then bonded to the prepared tooth with dental adhesive and resin cements.

Many good aesthetic resin cements are available:

i. Calibra™ (Dentsply)
ii. Variolink II™ (Ivoclar)

Light-cure/dual Cure Dental Adhesives

Prime and Bond NT Dual cure™ (Dentsply)

It is important that cementation kit should also have water soluble "try in paste" which has perfect shade match key to the cement shades. These pastes greatly simplify colour matching of the indirect restoration. It is also important that the base cement can be used light-cured and for veneers and then matched with a catalyst and can be dual cured (light activated and chemically activated) for crowns, inlays and onlays. Similarly it would be safe to use a dual-cure adhesive like Prime and Bond NT™ with a self-cured resin cement, as research by 'Reality group' has shown that a number of light-cure adhesives do not bond to the self-cure cements.

Impression Taking for Indirect Restorations

Beside aesthetics, the marginal fit of a restoration determines its clinical longevity in the oral cavity. Hence taking a perfectly accurate impression is mandatory in a well fitting restoration. Several factors influence the registering of impression of a prepared tooth.

i. *Gingival health:* Should be perfect to facilitate recording of an impression. In a pool of saliva/blood/exudates,

etc. it is almost impossible to record perfect impression. Hence prior supra and sub gingival scaling, by scaling and curettage technique should be done well in advance to achieve perfect gingival health.

ii. The impression tray should be rigid and of perfect size which locks the impression material (like Rimlock™ dentsply). It should not touch any part of the tooth.

iii. *Accurate impression material should be used:* Aqusil™ (Dentsply) a hydrophilic quadra functional modified polyvinyl siloxane contains four reactive vinyl groups which results in increased cross-linking of polymer web, than that obtained with conventional A-silicones. Its tear strength is very important in wet conditions and also results in superior cast production. The improved wetting ability of the material is of prime importance specially in recording perfect surface details in gingival sulcus areas.

iv. *Working time:* It is important that one should do fast work because if once polymerization of the impression material starts it should be discarded and a fresh impression should be planed. Because if polymerizing material rebounds after impression is made, unnoticed by the operator, it will result into a tight fitting crown.

Both low viscosity (LV) syringe marital and putty or medium viscosity (MV) tray materials should be flowable at time of recording the impression.

TECHNIQUE FOR RECORDING IMPRESSION

Gingival Retraction

It is better to use double cord retraction technique. The first cord is left in the sulcus and the second cord is packed on top of the first. Just prior to syringing the material around the tooth, the top cord is removed leaving the first

cord in sulcus. The advantage being no blood, serous discharge at the time of impression taking because blood, saliva, serous discharge, etc. can cause interference in the flow of material from the syringe.

Squeezing of syringe impression material is started from the bottom of the prepared crown and circulated around the stump (tooth) with the material against the tooth structure and only syringe tip being in the material, voids shall occur if the placement is done at different areas and then brought together. Care should be taken not to pull the material away from the tooth during the whole procedure.

It is important not to compress the material while taking it out of the oral cavity, because compression can cause permanent deformities of the impression. Break the seal of the impression holding tray from back of it and loosen it gradually to prevent tearing. Only after loosening of the impression the handle of tray should be used to take it out. Aquasil™ because of its quadra functional resin has excellent tear strength even in thin layers of the impression material.

After withdrawal check the impression with a magnifying glass for voids, wrinkles, bubbles and also specially that the prepared tooth do not touch the tray surface at any place. Small defects can be masked by technician but if the defect is large, repeat the impression procedure.

Bonding of the Metal Free Restoration

Etch the internal surface of the prepared restoration with 10 per cent hydrofluoric acid for 1 to 2 minutes.

Some recent studies recommend sand blasting of the internal surface of the preparation before treating with 10 per cent hydrofluoric acid. Examine the internal surface

for roughness of the etch, then clean the internal surface with regular 37 per cent etchant gel (phosphoric acid). This step does not etch the ceramic, except to clear the surface. Rinse thoroughly and dry the surface.

Apply silane to the sand blasted, etched and acidified internal surface of restoration and leave undisturbed for 1 minute. Blow out the excess gently with an air syringe for 5 seconds.

When the thickness of the restoration is less than 2 mm, only thin Prime and Bond NT™ is enough to bond the restoration by light-cure. If the thickness is more than 2 mm, it is safe to use Prime and Bond NT Dual cure™. Apply it on the internal surface of the restoration and also wet the tooth surface and then after 20 seconds, air dry both separately and light-cure each for 10 seconds. The film thickness of Prime and Bond NT™ is 6 to 7 microns and hence shall not disturb sealing of the restoration even if cured before cementation.

Now place the resin cement on the internal surface of the preparation and gently guide it into place on the prepared tooth till it sits completely. Remove the excess cement with brushes and interdental silk floss.

Light-cure the surface for 60 seconds from all the sides of the tooth, i.e. buccal, lingual/palatal, mesial and distal surfaces, individually for 60 seconds each surface.

Care should be taken not to use resin reinforced glass ionomer cement (RRGI'S) for cementing ceramic restoration, because it generally results in fracture of the crown, because of the forces of the internal expansion of the cementing material in the oral cavity. However, some of the recent RRGI'S like Protec Cem™ (Ivoclar) and compomer cement Dycal Cem Plus™ (Dentsply) claim very little expansion and are recommended for cementing of all ceramic restorations.

DIRECT PROVISIONAL CROWN AND BRIDGE MATERIAL

Self curing components material for creating direct temporary crown and bridge based on multifunctional methacrylic esters and glass fillers. It is free from methyl methacylate, therefore the finished temporaries have an excellent bio-compatibility and safe for the pulp at a low curing temperature of approximately 38°C. It attains compressive strength of 220 MPa, flexural strength 80 MPa, tensile strength of 36 MPa and knoop hardness of 17 HK. It is available in market under brand name of "Swift-Temp™". (Shofu Inc.).

The technique of using this material for fabricating temporary crowns etc. is self explanatory (Figs 11.1 to 11.4).

Diagrammatic representation of:

i. Pressed all ceramic crown making procedure shown in Figures 11.5 to 11.10.
ii. Crome Cobalt (Metallic) full crown with acrylic buccal facing (Figs 11.11 to 11.14).
iii. Dowel pin crown made on RCTed 12 (Figs 11.15 and 11.16).

Fig. 11.1: An impression is taken prior to tooth preparation

Fig. 11.2: After tooth preparation load the impression tray with Swift-Temp (Shofu Inc.) and place over the tooth preparation

Fig. 11.3: After 3 minutes remove the tray from the mouth

Fig. 11.4: Finish and polish the temporary restoration

Fig. 11.5: Teeth after bleaching with Nupro Gold (Dentsply). The direct composite bonding on the upper central incisors could not be bleached and hence appears darker than natural teeth

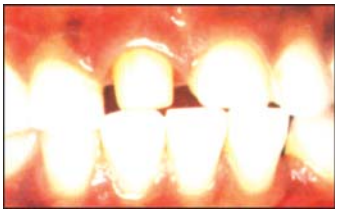

Fig. 11.6: Full veneer preparation on the right central incisor (endodontically treated) and partial veneer preparation on left central incisor

Fig. 11.7: Provisionals prepared from TPH Spectrum™ (Dentsply) and cemented with non-eugenol cement

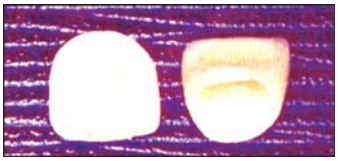

Fig. 11.8: Restorations outside the mouth

Fig. 11.9: Restoration seated on the master model

Fig. 11.10: Pressed all ceramic crown on right central incisor and pressed laminate veneer on left central incisor bonded with Prime and Bond NT Dual Cure™ (Dentsply) and Calibra Cement™ (Dentsply)

Fig. 11.11: Initial situation, note the broken but vital 14

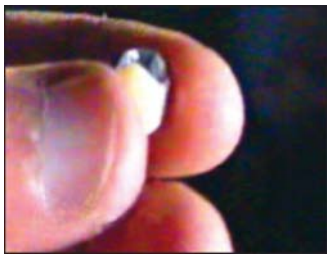

Fig. 11.12: After proper reduction impression were taken and a full chrome cobalt metallic crown with acrylic facing was planed

Fig. 11.13: Internal view of the prepared crown

Fig. 11.14: Final finished metallic crown with acrylic facing cemented on stump of 14

Fig. 11.15: Tooth prepared for dowel pin crown after root canal treatment of 12

Fig. 11.16: Dowel pin crown cemented in place on 12

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